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SUBJECT: REPORT ON DOE/STATE VISIT TO VAEC AND DALAT
RESEARCH REACTOR

REF: HANOI 0126

1. SUMMARY: A DOE/State delegation participated in meetings in Hanoi and Dalat, Vietnam on February 10 and 12 to discuss with Vietnamese officials and reactor operators a U.S. proposal to ship fresh fuel assemblies containing HEU to Russia and to convert the Dalat Research Reactor to LEU fuel. The Dalat reactor has 36 fresh fuel assemblies containing several kilograms of 36 percent enriched HEU. The reactor operators and officials of the Ministry of Science and Technology and the Atomic Energy Commission were receptive to the U.S. proposal and agreed to work with the Department of Energy (DOE) to ship the fresh fuel to Russia and to carry out the analytical studies necessary to convert the reactor. The Dalat Institute will begin immediately to work with Argonne National Laboratory (Argonne) on calculations for reshuffling the existing core and will send two scientists to Argonne later this spring. They agreed to permit the fresh fuel shipment as soon as they are assured that the removal of the fresh fuel will cause no interruption in the operation of the reactor. The Vietnam Atomic Energy Commission and the Nuclear Research Institute in Dalat see the fuel shipments and reactor conversion as a way to increase the level of peaceful nuclear cooperation between Vietnam and the U.S. Successful implementation of this effort should provide a solid basis for such cooperation in the future. END SUMMARY.

2. A DOE/State delegation visited Hanoi and Dalat February 10-12 to present a proposal to remove unused fresh high enriched uranium (HEU) fuel from the Dalat reactor and convert the reactor to low enriched uranium (LEU) fuel. The U.S. also proposed to assist Vietnam in shipping the spent HEU fuel to Russia after the reactor is converted. The delegation was led by Trisha Dedik, Director of DOE's Office of Nonproliferation Policy (NA-241) and included Igor Bolshinsky of Argonne National Laboratory, Diana Clark of DOE/GC and Allan Krass of State/NP/NE. The delegation visited the Vietnam Atomic Energy Commission (VAEC) in Hanoi on February 10 and met with a delegation led by VAEC Chairman Dr. Vuong Huu Tan. After the meeting U.S. delegation paid a courtesy call on Vice Minister of Science and Technology Hoang Van Huay. MOST has responsibility for VAEC, which in turn supervises the Nuclear Research Institute (NRI) in Dalat, at which the reactor is located. On February 12, the U.S. delegation visited NRI and met with Director Dr. Nguyen Nhi Dien. The delegation was given a thorough tour of the reactor and hot cell facilities and discussed in detail the U.S. proposal, and questions and suggestions raised by the Vietnamese side.

3. At the VAEC meeting the U.S. side presented its proposal and the Vietnamese side responded with an agreement in principle, but also voiced some concerns and raised some questions. They first provided a detailed inventory of the fresh and irradiated fuel elements: 142 elements total, with 104 in the core (irradiated), 36 fresh elements, and 2 instrumented elements used only for temperature measurements in the core. A shipment of fresh fuel would, therefore, comprise the 36 fresh elements currently in storage at the site. The 36 fresh fuel assemblies contain a total of 4 kilograms of HEU enriched to 36 percent in U-235. The primary concern raised by VAEC was that the fuel shipments should cause no interruption in the operation of the reactor, which is used for medical isotope production, neutron activation analysis, fundamental research and teaching/training. They also expressed concern that conversion to LEU would not significantly degrade the performance of the reactor. Finally, they inquired whether any new agreements would be required between Vietnam and the United States or between Vietnam and Russian to implement the fuel shipments.

4. The U.S. delegation responded by assuring VAEC that there would be no interruption in the reactor's operation and that the Reduced Enrichment for Research and Test Reactors (RERTR) Program, based at Argonne, would be able to demonstrate that conversion to LEU would have only a marginal effect on critical reactor parameters such as neutron flux and fuel lifetime. The U.S. delegation made clear that VAEC would be provided with all the analytical studies necessary to demonstrate the effectiveness and safety of the conversion, and that Vietnamese scientists would be invited to Argonne to participate alongside U.S. scientists in the performance of these studies.

5. Diana Clark of DOE/GC addressed the issue of necessary agreements. She noted that no agreement would be necessary for the fresh fuel shipment, since this can be handled through the International Atomic Energy Agency (IAEA) in a manner similar to

that already used in Romania and Bulgaria. A bilateral government-to-government agreement would be required for the spent fuel shipment, since U.S. support for such a shipment will be contingent on obtaining appropriate liability protection, tax and customs exemptions, and privileges and immunities for any U.S. participants.

16. A separate implementing agreement between DOE and NRI also will be required under the umbrella of the government-to-government agreement. However, the spent fuel shipment will not take place until after the reactor conversion is complete and the fuel has had time to cool down, which gives the parties time to negotiate these agreements. The capacity of the spent fuel pool at Dalat is 300 elements, and there are currently no spent fuel elements stored in the pool. This means there is no pressure for a spent fuel shipment and scheduling of such a shipment can be coordinated with spent fuel shipments from other countries. The U.S. delegation also urged the VAEC to begin bilateral discussions with the Russian Government on agreements that will be necessary if Russia is to accept the spent fuel.

17. Discussions continued at the NRI facility in Dalat on February 12. This time the Vietnamese side was led by NRI Director Dien, who also provided a tour of the reactor, hot cells and isotope production labs. The facility appears to be well run and maintained, and there was evidence of an active isotope production program. Dien claimed that NRI provides about 40 percent of Vietnam's requirements for medical isotopes, with the other 60 percent being imported from France and Hungary. Dien provided an overview of the history of the reactor, noting that it was originally supplied by the U.S. as a Triga Mark II, with a power of 250 kilowatts. It first went critical in February of 1963, but was shut down between 1968 and 1975. The original U.S.-origin fuel was removed in 1975. The reactor was upgraded and restarted under an IAEA project (VIE/4/004) in 1983 and now has the designation IVV-9 and a rated power of 500 kilowatts. It uses Russian-origin VVR-M2 fuel assemblies, each of which contains 40 grams of 36 percent enriched uranium. The reactor has operated for about 26,000 full power hours since 1983 and has had its control and instrumentation system upgraded under an IAEA technical cooperation project (VIE/4/10) in 1992-94.

18. Since it renewed operation, the reactor has been managed by adding new fuel assemblies (FAs) to the core as burnup reduces the reactivity of existing assemblies. The core operated on 89 FAs from 1984-94, 100 FAs from 1994-2002 and now contains 104 FAs. Current plans are to add six more in 2006, but Dien suggested that with Argonne's help they may be able to reshuffle the existing 104 FAs to permit an extra year or two of operation before adding fresh fuel. The U.S. side agreed to ask Argonne to do the calculations necessary to optimize the reshuffling. Dien agreed to provide the data to ANL as soon as possible. The existing fresh fuel inventory is expected to last until 2015, and Dien wanted assurance that if the HEU fresh fuel were shipped to Russia and the reactor converted to LEU, the U.S. would provide sufficient LEU fuel to allow operation to the same date. The Government of Vietnam is studying the possibility of building a new 10-megawatt research reactor after 2015, but no definite plans exist at this time.

19. Dien produced a list of "requests" related to Vietnamese acceptance of the U.S. proposal. They included:

- no interruption of reactor operation,
- no change in core construction,
- minimal change in flux and other important operational parameters,
- enough LEU fuel to operate until 2015,
- two instrumented LEU FAs for research purposes, and
- help from U.S. Triga experts on evaluation of the pool tank, reflector and horizontal channels, all of which are originally of Triga design.

10. Discussion of these requests and their consistency with the U.S. proposal led to general Vietnamese acceptance of the U.S. proposal and agreement on the following sequence of steps. Argonne will inform NRI of what data it needs to complete the reshuffling calculations and will also begin the preliminary neutronic and thermo-hydraulic calculations required for conversion licensing. When it is clear that the core reshuffling will permit sufficient operation without addition of fresh fuel, NRI will permit the fresh fuel to be shipped to Russia. NRI will make a preliminary application to VAEC for approval of conversion, which will allow VAEC to begin its analysis. But VAEC approval will depend on submission of a full safety analysis report (SAR) and on ministerial approval of the conversion. Two NRI scientists will visit Argonne, probably in April-May or May-June, to participate in the studies for the SAR. VAEC stated that it will take approximately six months from the time of receipt of the final SAR to grant a license for the conversion. Once this license is granted, the LEU fuel can be ordered from the Russian manufacturer. Allowing six to eight months for fuel fabrication and delivery, it seems feasible that conversion of the reactor could take place sometime in 2005. Meanwhile, VAEC and the Government of Vietnam will begin discussions with the Russian Government and Minatom on arrangements for return of the spent

fuel. The spent fuel shipment could be scheduled for as early as a year after the conversion is complete, but this will depend on the outcome of Vietnam-Russia discussions and the conclusion of appropriate bilateral agreements between Vietnam and the U.S.

11. COMMENT: The discussions in both Hanoi and Dalat were open, friendly and productive. The concerns and questions presented by the Vietnamese side were all serious and reasonable, and they were presented in a positive and cooperative manner. Both VAEC and NRI made it clear that they supported the U.S. proposal in principle, and once their concerns were addressed, they both agreed that they could move forward on the basis of the timetable outlined in paragraph 10. It seems quite clear that VAEC and NRI see the fuel shipments and reactor conversion as a way to increase the level of peaceful nuclear cooperation between Vietnam and the U.S. Successful implementation of this effort should provide a solid basis for such cooperation in the future. END COMMENT

12. Finally, the delegation wants to express its heartfelt thanks and appreciation to Gary Sigmon, Jonathan Hilton and Michael Cavanaugh for their efficient and indispensable help in preparing for and conducting this visit. This cable was drafted and cleared by the delegation.

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